

EFFECTIVE USE OF TEST TYPES FOR SOFTWARE DEVELOPMENT

F.H.A.R.Silva

149042M

Dissertation submitted in partial fulfillment of the requirements for the Master of
Business Administration in
Management of Technology

Department Of Management of Technology

University of Moratuwa
Sri Lanka

January 2016

Declaration

I certify this dissertation does not incorporate, without acknowledgement, any material previously submitted for a Degree or Diploma in any University and to the best of my knowledge and belief, it does not contain any material previously published or written by another person or myself except where due reference is made in the text.

Also I hereby grant to University of Moratuwa the non-exclusive right to reproduce and distribute my thesis/dissertation, in whole or in part in print, electronic or other med

.....

Date:

Signature of the candidate

The above candidate has carried out the research for Masters Dissertation under my supervision.

.....

Date:

Signature of the supervisor

Name of the Supervisor: Eng. Kithsiri Samarasinghe

Abstract

The purpose of this study is to conduct an analysis on the effective use of test types for software development. The quality of the product is very important to satisfy clients and stay in business. Therefore software testing has become an important phase in the software development life cycle. As a result of the literature survey, the researcher has developed conceptual model and three hypotheses were derived based on the conceptual model. First three research objectives were accomplished by testing hypotheses using Pearson correlation and Regression analysis. Recommendation were given based on interview feedback, hypotheses output and descriptive statistical analysis. This study is conducted using a deductive approach. Data was collected from Quality Assurance professionals in Sri Lanka who are involved in Quality Assurance planning activities. The researcher has sent online questionnaire to collect raw data and also conducted interviews with quality assurance managers to identify their recommendations to use test types effectively. According to the hypotheses testing results it can be proved that there is an impact from testing constraints such as time, skills and poor requirements to test type selection and execution. It is also important to consider the application architecture type before selecting and executing test types. There is an impact from testing constraints to quality characteristics defined in ISO 9126 Model. In conclusion, when considering the result of this research, there is an impact from time constraints, skill constraint and poor requirements to the selection and execution of test types and limitation in testing of ISO 9126 quality characteristics. Most of the companies consider Web, Service, Mobile and Internet applications when select test types. So it is recommended to overcome time constraint with proper time management and skill constraints taking actions to improve skills.

Keywords: Test Types, ISO 9126 Model, Testing Constraints, Application Architecture Type

Acknowledgement

First I would like to extend my sincere gratitude to my supervisors Eng. Kithsiri Samarasinghe, Senior Lecturer of Department of Electronics and Telecommunication, University of Moratuwa for his precious support, advices and guidance given during the research.

I would like to express my gratitude to all academic and non- academic staff of Management of Technology Department in University of Moratuwa who helped in numerous way during the academic period.

I sincerely thank all IT professionals especially QA for extending their support by sending responses for questionnaire and assistance to research exercise. Special thanks goes to all interviewees who allocate time slot from their valuable time to conduct interviews and sharing their experiences.

I am thankful to MBA colleagues and friends who have given me tremendous support, continuous motivation and encouragement to make this success. Finally thank my parents for their patience, encouragements and assistance in making this success.

Table of Contents

Declaration.....	ii
Abstract.....	iii
Acknowledgement	iv
Table of Contents.....	v
List of Figures	viii
List of Tables	ix
Chapter 1: Introduction	1
1.1 Background study	1
1.2 Problem statement of the study.....	3
1.3 Research questions.....	4
1.4 Research Objectives.....	4
1.5 Significance of the study.....	4
1.6 Scope.....	5
1.7 Summary	6
Chapter 2: Literature Review	7
2.1 Introduction.....	7
2.2 Definition of testing	7
2.3 Objective of Testing.....	7
2.4 Test Types	8
2.4.1 Testing of function	9
2.4.3 Testing of Software Structure	14
2.4.4 Testing related to changes.....	15
2.5 ISO 9126 Model.....	16
2.6 Testing Constraints	20
2.6.1 Limited schedule constraints.....	21
2.6.2 Limited Budget Constraint.....	23
2.6.3 Lacking or poorly written requirement	24
2.6.4 Changes in technology	25
2.6.5 Limited tester's skills.....	25
2.7.1 Mobile Application	26
2.7.2 Web Application	26

2.7.3 Service Application.....	26
2.7.4 Rich Client Application	26
2.7.5 Rich Internet Application.....	27
2.8 Summary	27
Chapter 3. Methodology of Study.....	28
3.1 Introduction.....	28
3.2 Research Approach	28
3.3 Conceptual Model.....	28
3.4 Hypothesis Development	31
3.5 Operationalization of the variables	33
3.6 Selection of the study sample	35
3.6.1 Population	35
3.7 Method of Data Collection.....	39
3.8 Method of Data Analysis	39
Chapter 4: Analysis and Discussion of Results	41
4.1 Introduction.....	41
4.2 Demographic Factor Analysis.....	41
4.2.1 Designation	42
4.2.2 Experience of Respondents.....	43
4.2.3 Education Level	44
4.2.4 Company Ownership	45
4.2.5 Company Size	46
4.2.6 Company Category	47
4.2.7 ISO 9126 Knowledge.....	48
4.3 Reliability and Validity Analysis.....	49
4.3.1 Reliability and Validity of Testing Constraints	49
4.3.2 Reliability and Validity of Application Architecture Type.....	52
4.3.3 Reliability and Validity of Level of Test Type Execution.....	54
4.3.4 Reliability and Validity of Limitation of ISO 9126 Quality Characteristics	54
4.4 Descriptive Analysis	55
4.5 Inferential Statistical Analysis and Testing of Hypothesis	56
4.5.1 Testing Normality	56
4.5.2 Hypothesis testing.....	61

4.5.3 Analysis Summary	78
4.6 Organization Category Level Analysis	80
4.7 Interview Discussion Summary	82
Chapter 5: Conclusions and Recommendations.....	86
5.1 Introduction.....	86
5.2 Discussion and Managerial implication.....	86
5.3 Recommendation	90
5.4 Limitations	92
5.5 Future Research Areas	93
5.5 Conclusion	94
References	95
Appendix A.....	98
Survey on Effective use of testing types for Software development	98
Section A.....	98
Section B.....	100
Appendix B	104

List of Figures

Figure 2. 1: ISO 9126 Model	16
Figure 2. 2: ISO 9126 Quality Characteristics.....	20
Figure 2. 3: Defect Cost	23
Figure 2. 4: Defect Cost 2	24
Figure 3. 1: Conceptual Model.....	29
Figure 3. 2:Growth of ICT work Force.....	36
Figure 3. 3: Job Categories	37
Figure 3. 4:Revenue of ICT companies	38
Figure 4. 1:Designation.....	42
Figure 4. 2:Experience	43
Figure 4. 3:Education Level.....	44
Figure 4. 4: Company Ownership.....	45
Figure 4. 5:Employee Count (Size).....	46
Figure 4. 6:Company Category	47
Figure 4. 7:ISO Knowledge	48
Figure 4. 8: Normality Curve-Testing Constraints	56
Figure 4. 9:Boxplot Diagram Testing Constraints	57
Figure 4. 10:Normality Plot Application Type	58
Figure 4. 11:Boxplot Application Type	58
Figure 4. 12:Normality Plot Test Types	59
Figure 4. 13:Boxplot Test Types	59
Figure 4. 14:Normality Plot ISO Characteristics	60
Figure 4. 15: Boxplot ISO Characteristics.....	60
Figure 4. 16: Scatter plot- Hypothesis 1	63
Figure 4. 17:Scatter plot- Hypothesis 2	68
Figure 4. 18: Scatter plot- Hypothesis 3	73
Figure 4. 19:Correlation Summary.....	78
Figure 4. 20:Testing Constraint Vs Organization Category.....	80
Figure 4. 21:Level of Test Type Execution Vs Organization Category	81

List of Tables

Table 3. 1 Operational Definition of conceptual model and variables	31
Table 3. 2: Operationalization Table.....	34
Table 4. 1: Reliability Analysis Cronbach Alpha-Testing Constraints.....	49
Table 4. 2: Reliability Analysis Detailed -Testing Constraints.....	50
Table 4. 3: Communalities- testing Constraints.....	50
Table 4. 4: Component Matrix- Testing Constraints	50
Table 4. 5: Reliability Analysis Cronbach Alpha-After Adjustments-Testing Constraints	51
Table 4. 6: Communalities- After Adjustments-testing Constraints.....	51
Table 4. 7: Component Matrix- After Adjustments-Testing Constraints	51
Table 4. 8:Reliability Analysis Cronbach Alpha-Application Type.....	52
Table 4. 9: Reliability Analysis Detailed -Application Type.....	52
Table 4. 10:Communalities- Application Type.....	53
Table 4. 11:Component Matrix- Application Type	53
Table 4. 12:Reliability Analysis Cronbach Alpha-After Adjustments-Application Type	53
Table 4. 13: Reliability Analysis Cronbach Alpha-Level of Test Type Execution	54
Table 4. 14: Reliability Analysis Cronbach Alpha-ISO 9126 Quality Characteristics	54
Table 4. 15:Descriptive Statistics	55
Table 4. 16:Pearson Correlation range.....	62
Table 4. 17: Pearson Correlation -Hypothesis 1	64
Table 4. 18:Model Summary- Hypothesis 1	65
Table 4. 19:ANOVA- Hypothesis 1.....	66
Table 4. 20:Coefficient- Hypothesis 1	66
Table 4. 21:Pearson Correlation -Hypothesis 2	69
Table 4. 22: Model Summary- Hypothesis 2.....	70
Table 4. 23:ANOVA- Hypothesis 2.....	71
Table 4. 24: Coefficient- Hypothesis 2	71
Table 4. 25: Pearson Correlation -Hypothesis 3	74
Table 4. 26:Model Summary- Hypothesis 3	75
Table 4. 27:ANOVA- Hypothesis 3.....	76
Table 4. 28:Coefficient- Hypothesis 3	76

List of Abbreviations

IT- Information Technology

QA-Quality Assurance

ICT- Information and Communication Technology

KPI- Key Performance Index

ISO- International Organization for Standardization

TDD- Test Driven Development

BDD- Behavior Driven Development

ROI- Return On Investment

ICTA- Information and Communication Technology Agency of Sri Lanka

SLASSCOM: Sri Lanka Association of Software Service Companies

TC- Testing Constraint

SC-Skill Constraint

PR- Poor Requirement

MA-Mobile Application

WA-Web Application

SA-Service Application

IA-Internet Application

SPSS - Statistical Software Package used for Statistical analysis

ANOVA- Analysis Of Variance